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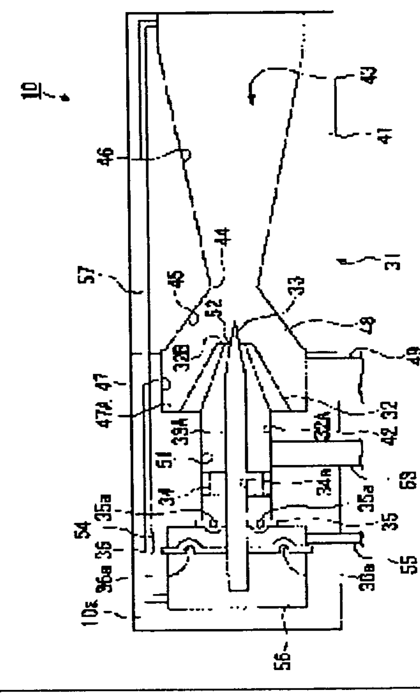
(54) VARIABLE FLOW EJECTOR AND FUEL CELL SYSTEM EQUIPPED WITH IT

(57)Abstract:

PROBLEM TO BE SOLVED: To perform a pressure/flow control precisely using a simple configuration not requiring electric control.

SOLUTION: A variable flow ejector 10 according to the invention is composed of a nozzle 32, a needle 33, and a diaphragm 35 and a second diaphragm 36. The nozzle 32 is furnished internally with a fluid passage 51 for supplying the fuel from a fuel supply part through a supply side pressure control part. The needle 33 extending along the axis of the nozzle 32 is inserted into the passage 51 and held in such a way as slidable in the axial direction. The upstream end of the passage 51 is blocked with the first diaphragm 35. The two diaphragms 35 and 36 located separately are connected fast to the base end of the needle 33. The diaphragms 35 and 36 and a casing 10a constitute an air extreme pressure lead-in chamber 54, while the second diaphragm 36 and the casing 10a constitute a fuel extreme pressure lead-in chamber 56.



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CLAIMS

[Claim(s)]
[Claim 1] The nozzle which has opening in a case, and a head and a end face, respectively, and injects the 1st fluid from opening at this head, The diffuser which is formed in the medial-axis line and the same axle of this nozzle, attracts the 2nd fluid with the negative pressure generated around said 1st fluid injected from said nozzle, is made to join said 1st fluid, and is sent out, While being inserted in the interior of said nozzle at said medial-axis line and same axle, and a perimeter's being stopped by this case with the needle arranged possible [displacement] along with said medial-axis line and blockading opening of the end face of said nozzle While it is estranged and arranged from the 1st diaphragm made movable and said 1st diaphragm in the direction which was connected to said needle and met said medial-axis line and a perimeter is stopped by said case The 2nd diaphragm made movable in the direction which was connected to said needle and met said medial-axis line, It is formed with said 1st and 2nd diaphragms and said case, and said 1st diaphragm is minded. The 3rd fluid room where the interior of said nozzle to which said 1st fluid is supplied is adjoined, it is arranged, and the 3rd fluid is supplied to the interior, It is formed with the 2nd diaphragm and said case, and said 2nd diaphragm is minded. The 3rd fluid room to which said 3rd fluid is supplied is adjoined, and it is arranged, and has the 4th fluid room where the 4th fluid is supplied to the interior. Said needle By displacing in the direction which met said medial-axis line with said 1st and 2nd diaphragms which move according to the pressure of said 1st fluid, said 3rd fluid, and said 4th fluid The adjustable flow rate ejector characterized by changing the area of the gap between opening at said head, and said needle.
[Claim 2] It is the fuel cell system equipped with the adjustable flow rate ejector characterized by being the fuel cell system equipped with the adjustable flow rate ejector according to claim 1, for said 1st fluid being a fuel supplied toward the anode of a fuel cell from a fuel-supply means, and said 2nd fluid being a blowdown fuel discharged from said fuel cell.
[Claim 3] It is the fuel cell system which said 3rd fluid is an oxidizer supplied to the cathode of said fuel cell from an oxidizer supply means, and was equipped with the adjustable flow rate ejector according to claim 2 characterized by said 4th fluid being said 1st fluid sent out from said diffuser, and an interflow object of said 2nd fluid.
[Claim 4] It is the fuel cell system which supplied said fuel with the pressure value which said fuel-supply means adds a predetermined value to the pressure value of said oxidizer, and is acquired, and was equipped with the adjustable flow rate ejector according to claim 3 characterized by setting up the surface ratio of said 1st diaphragm and said 2nd diaphragm based on said predetermined value and the value of the electrode differential pressure between said anodes and said cathodes of said fuel cell.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] A fuel cell etc. is equipped with this invention, it relates to the ejector to which it mixes with the fuel newly supplied and the recirculation of the blowdown fuel discharged from a fuel cell is carried out, and relates to the technique which makes the flow rate of a fuel adjustable especially.
[0002]
[Description of the Prior Art] As opposed to the cel which the solid-state macromolecule membrane type fuel cell put the solid-state polyelectrolyte film from both sides with the anode and the cathode conventionally, and was formed It has the stack (it is called a fuel cell to below) constituted by carrying out the laminating of two or more cels. Hydrogen is supplied to an anode as a fuel, air is supplied to a cathode as an oxidizer, the hydrogen ion generated by catalytic reaction in the anode passes the solid-state polyelectrolyte film, and moves even a cathode, and with a cathode, oxygen and electrochemical reaction are caused and it generates electricity. Here, in order to maintain the ion conductivity of a solid-state molecule electrolyte membrane, superfluous water is mixed with humidification equipment etc. by the hydrogen supplied to a fuel cell. For this reason, water collects on the gas passageway in the electrode of a fuel cell, and the predetermined blowdown flow rate is set to the blowdown fuel so that this gas passageway may not be closed. Under the present circumstances, by mixing and carrying out the recirculation of the blowdown fuel to the fuel newly introduced into a fuel cell, a fuel can be utilized effectively and the energy efficiency of a solid-state macromolecule membrane type fuel cell can be raised.
[0003] Conventionally, the fuel cell equipment to which the recirculation of the blowdown fuel is carried out with an ejector is known like the fuel cell equipment indicated by JP,9-213353,A as fuel cell equipment which was mentioned above. Here, an ejector connects [opening / of the diffuser which has taper-like inner skin / end face] a sub** room, projects the point of the nozzle arranged at a diffuser and the same axle to sub******, is made to face it end face opening of a diffuser, and is constituted. The fuel supplied to an ejector is injected toward end face opening of a diffuser from the point of a nozzle, and the blowdown fuel introduced into sub****** as was drawn in the style of [of this high speed] the fuel is taken to a diffuser.
[0004] With this fuel cell equipment, the pressure gage is built into the passage for the recirculation of a blowdown fuel, based on the detection result by this pressure gage, accommodation control of the opening of the fuel-supply valve of an ejector is carried out, and the flow rate of the blowdown fuel mixed by the ejector and the newly introduced fuel is changed. And based on the detection result by the flowmeter formed in the lower stream of a river of an ejector, the amount of the fuel consumed with a fuel cell, i.e., the output of fuel cell equipment, is controlled by feedback control to the flow rate of a blowdown fuel and the newly introduced fuel being performed.
[0005] Moreover, the rod which can be displaced in the direction of an axis is built in the interior of a nozzle, and it is made for the adjustable flow rate ejector indicated by JP,8-338398,A, for example to have the opening area at the head of a nozzle changed in the direction of an axis by carrying out a variation rate by the actuator which prepared this rod separately. According to this adjustable flow rate ejector, the index value which is the ratio (Qt/Qa) of the fuel flow Qt which flows out of the diffuser to the SUTOIKI value Qa, i.e., the fuel flow spouted from a nozzle, and shows the magnitude of the attraction effectiveness over the fuel flow attracted by the diffuser from the sub** room of an ejector can be made adjustable by changing the opening area at the head of a nozzle.
[0006]
[Problem(s) to be Solved by the Invention] However, when it has the ejector made flow rate adjustable by the variable orifice etc. like fuel cell equipment with an example of the above-mentioned conventional

technique, it is necessary to detect the pressure and flow rate of a fuel in two or more passage in fuel cell equipment, and to perform feedback control, and there is a problem that the structure of fuel cell equipment and control will be complicated. Furthermore, in order to control the predetermined electrode differential pressure needed by the proper actuator between the fuel electrode of a fuel cell, and an air pole in the device which makes a flow rate adjustable like an adjustable flow rate ejector with an example of the above-mentioned conventional technique, control by the high resolution is needed and the problem that costs will increase by improving or an actuator will enlarge the precision of an actuator arises. This invention was not made in view of the above-mentioned situation, and though it is the simple configuration which does not need electric control, it aims at offering the adjustable flow rate ejector in which the amount control of pressure flow of desired high degree of accuracy is possible.

[0007]

[Means for Solving the Problem] In order to attain the object which solves the above-mentioned technical problem and starts, the adjustable flow rate ejector of this invention according to claim 1 The nozzle which has opening, respectively in a case (for example, case 10a in the gestalt of operation mentioned later), and a head and a end face, and injects the 1st fluid from opening at this head (for example, nozzle 32 in the gestalt of operation mentioned later), It is prepared in the medial-axis line and the same axle of this nozzle, and the 2nd fluid is attracted with the negative pressure generated around said 1st fluid injected from said nozzle. The diffuser which is made to join said 1st fluid and is sent out (for example, diffuser 31 in the gestalt of operation mentioned later), The needle which was inserted in the interior of said nozzle at said medial-axis line and same axle, and has been arranged possible [displacement] along with said medial-axis line (for example, needle 33 in the gestalt of operation mentioned later), While a perimeter is stopped by this case and blockading opening of the end face of said nozzle The 1st diaphragm made movable in the direction which was connected to said needle and met said medial-axis line (for example, the 1st diaphragm 35 in the gestalt of operation mentioned later), While it is estranged and arranged from said 1st diaphragm and a perimeter is stopped by said case The 2nd diaphragm made movable in the direction which was connected to said needle and met said medial-axis line (for example, the 2nd diaphragm 36 in the gestalt of operation mentioned later), It is formed with said 1st and 2nd diaphragms and said case, and said 1st diaphragm is minded. The 3rd fluid room where the interior of said nozzle to which said 1st fluid is supplied is adjoined, it is arranged, and the 3rd fluid is supplied to the interior (for example, air extreme pressure induction room 54 in the gestalt of operation mentioned later), It is formed with the 2nd diaphragm and said case, and said 2nd diaphragm is minded. The 4th fluid room where the 3rd fluid room to which said 3rd fluid is supplied is adjoined, it is arranged, and the 4th fluid is supplied to the interior It has. (For example, fuel extreme pressure induction room 56 in the gestalt of operation mentioned later) Said needle It is characterized by changing the area of the gap between opening at said head, and said needle by displacing in the direction which met said medial-axis line with said 1st and 2nd diaphragms which move according to the pressure of said 1st fluid, said 3rd fluid, and said 4th fluid.

[0008] According to the adjustable flow rate ejector of the above-mentioned configuration, the 1st fluid supplied to the interior of a nozzle is spouted from opening at the head of a nozzle. Here, the needle which can be displaced in the direction of a medial-axis line is inserted in the interior of a nozzle, by adjusting the location of this needle, the area of the gap between opening at the head of a nozzle and a needle can be changed by making a needle project from opening at the head of a nozzle etc., and the 1st fluid flow spouted from this gap can be adjusted. The 1st and 2nd movable diaphragms of two sheets are connected in the direction of a medial-axis line, and when these 1st and 2nd diaphragms move, the displacement location of a needle is changed into a needle.

[0009] Here, the 1st diaphragm has separated the interior and the 3rd fluid room of a nozzle, and moves by balance of the pressure of the 1st fluid supplied to the interior of a nozzle, and the pressure of the 3rd fluid supplied to the 3rd fluid room. Moreover, the 2nd diaphragm moves by balance of the pressure of the 3rd fluid which has separated the 3rd fluid room and the 4th fluid room, and is supplied to the 3rd fluid room, and the pressure of the 4th fluid supplied to the 4th fluid room. Thereby, the flow rate of the interflow object of the 1st fluid and the 2nd fluid which are sent out from a diffuser can be appropriately adjusted only by the mechanical control based on pressure balancing of the 1st fluid, the 3rd fluid, and the 4th fluid. Though it is a simpler configuration compared with the case where control of flow of a high resolution and high degree of accuracy is performed using an electric actuator etc. thereby, for example, the amount control of pressure flow with desired high dependability can be performed.

[0010] Moreover, the fuel cell system of this invention according to claim 2 is a fuel cell system equipped with the adjustable flow rate ejector according to claim 1, said 1st fluid is a fuel supplied toward the anode

of a fuel cell from a fuel-supply means (for example, fuel-supply lateral pressure control section 27 in the gestalt of operation mentioned later), and said 2nd fluid is characterized by being the blowdown fuel discharged from said fuel cell.

[0011] In case the recirculation of the blowdown fuel discharged from a fuel cell is mixed and carried out to the fuel newly supplied by the fuel cell with a predetermined blowdown flow rate according to the fuel cell system of the above-mentioned configuration, the flow rate of the interflow object of the fuel supplied to a fuel cell and a blowdown fuel can be appropriately adjusted only by the mechanical control based on pressure balancing of the 1st fluid, the 3rd fluid, and the 4th fluid. Though it is a simpler configuration compared with the case where control of flow of a high resolution and high degree of accuracy is performed using an electric actuator etc. thereby, for example, the amount control of pressure flow with desired high dependability can be performed, it can prevent complicating control of a fuel cell system, and the costs required in case a system is built can be reduced.

[0012] Furthermore, the fuel cell system of this invention according to claim 3 is an oxidizer with which said 3rd fluid is supplied to the cathode of said fuel cell from an oxidizer supply means (for example, oxidizer feed zone 24 in the gestalt of operation mentioned later), and said 4th fluid is characterized by being said 1st fluid sent out from said diffuser, and the interflow object of said 2nd fluid.

[0013] According to the fuel cell system of the above-mentioned configuration, it becomes the pressure differential of the oxidizer supplied to a fuel cell, and the fuel supplied from a fuel-supply means at the 1st diaphragm, and the pressure differential of the 3rd fluid and the 4th fluid which act on the 2nd diaphragm serves as electrode differential pressure of a fuel cell. Even if it is the case where the amount of the fuel consumed with a fuel cell changed by this (for example, reduction), and the electrode differential pressure of a fuel cell changes (for example, buildup) With change of the pressure differential which acts on the 1st and 2nd diaphragms, the 1st and 2nd diaphragms move and the flow rate of the interflow object of the fuel and blowdown fuel which are sent out from an adjustable flow rate ejector is changed into a suitable value by the displacement location of the needle in the interior of a nozzle being changed. Though it is a simpler configuration compared with the case where control of flow of a high resolution and high degree of accuracy is performed using an electric actuator etc. thereby, for example, reliable control of flow can be performed holding the electrode differential pressure of the request needed for a fuel cell.

[0014] Furthermore, the fuel cell system of this invention according to claim 4 supplies said fuel with the pressure value which said fuel-supply means adds a predetermined value to the pressure value of said oxidizer, and is acquired, and surface ratio of said 1st diaphragm and said 2nd diaphragm is characterized by being set up based on said predetermined value and the value of the electrode differential pressure between said anodes and said cathodes of said fuel cell.

[0015] According to the fuel cell system of the above-mentioned configuration, based on the electrode differential pressure of a fuel cell, and the supply pressure of the fuel according to the pressure of the oxidizer in a fuel-supply means, the surface ratio which will be in the keeping condition of a pressure in each of the 1st and 2nd diaphragms first in the condition of having not received the pressure can be set up. Then, when a pressure is applied and change of the electrode differential pressure of a fuel cell etc. occurs, the displacement location of the needle in the direction of a medial-axis line is changed because the 1st and 2nd diaphrams move from this keeping condition, and the flow rate of the fuel supplied to a fuel cell and a blowdown fuel is automatically set as a suitable value.

[0016]

[Embodiment of the Invention] It explains referring to an accompanying drawing hereafter about the adjustable flow rate ejector concerning 1 operation gestalt of this invention. Drawing 1 is the block diagram of the fuel cell system 20 equipped with the adjustable flow rate ejector 10 concerning 1 operation gestalt of this invention, and drawing 2 is the sectional side elevation of the adjustable flow rate ejector 10 concerning 1 operation gestalt of this invention. The fuel cell system 20 carried in cars, such as an electric vehicle, is equipped with the adjustable flow rate ejector 10 by the gestalt of this operation, and this fuel cell system 20 is equipped with the adjustable flow rate ejector 10, a fuel cell 21, the fuel-supply section 22, the humidification section 23, the oxidizer feed zone 24, the heat exchange section 25, the water separation section 26, and the fuel-supply lateral pressure control section 27, and is constituted.

[0017] The fuel cell 21 consisted of a stack constituted by carrying out the laminating of two or more cels to the cel which put the solid-state polyelectrolyte film which consists for example, of solid-state polymer ion exchange membrane etc. from both sides with the anode and the cathode, and was formed, and is equipped with the fuel electrode with which hydrogen is supplied as a fuel, and the air pole to which the air which contains oxygen as an oxidizer is supplied.

[0018] Air exhaust port 21b in which the air exhaust valve 28 for discharging outside air supply opening 21a to which air is supplied from the oxidizer feed zone 24, the air in an air pole, etc. was formed is prepared in the air pole. On the other hand, 21d of fuel exhaust ports for discharging outside fuel-supply opening 21c to which hydrogen is supplied, the hydrogen in a fuel electrode, etc. is prepared in the fuel electrode.
[0019] After it mixed the steam to the oxidizer (for example, air) supplied from the oxidizer feed zone 24 and humidified air, it was supplied to the fuel cell 21, and has secured the ion conductivity of a solid-state molecule electrolyte membrane while supplying it to a fuel cell 21, after the humidification section 23 mixes a steam to the fuel supplied from the fuel-supply section 22 and humidifies hydrogen. It supplies air as an object for the pressure control of the adjustable flow rate ejector 10 further as signal pressure in the fuel-supply lateral pressure control section 27 so that it may mention later, while the oxidizer feed zone 24 consists of an air compressor, is controlled according to the input signal from the load and accelerator pedal (graphic display abbreviation) of a fuel cell 21 etc. and supplies air to the air pole of a fuel cell 21 through the heat exchange section 25. The heat exchange section 25 warms the air from the oxidizer feed zone 24 to predetermined temperature, and supplies it to the fuel cell 21.
[0020] The hydrogen as a fuel is supplied to the fuel electrode of a fuel cell 21 from fuel-supply opening 21c one by one through the fuel-supply lateral pressure control section 27, the adjustable flow rate ejector 10, and the humidification section 23. Furthermore, the blowdown fuel discharged from 21d of fuel exhaust ports of a fuel cell 21 is removed in moisture in the water separation section 16, is introduced through the check valve 29 to the adjustable flow rate ejector 10, and the fuel supplied from the fuel-supply lateral pressure control section 27 and the blowdown fuel discharged from the fuel cell 21 are mixed, and it is supplied to the fuel cell 21 so that it may mention later.
[0021] The fuel-supply lateral pressure control section 27 consisted of a proportion pressure control valve of for example, an air type, made signal pressure the pressure of the air supplied from the oxidizer feed zone 24, and the fuel which passed the fuel-supply lateral pressure control section 27 has set the pressure which it has at the outlet of the fuel-supply lateral pressure control section 27, i.e., a supply pressure, as a predetermined value.
[0022] The adjustable flow rate ejector 10 by the gestalt of this operation As the flow rate of the fuel supplied to a fuel cell 21 is controlled based on the pressure Pair of the air by the side of the air pole of a fuel cell 21, and the pressure Pfuel of the fuel by the side of the fuel electrode of a fuel cell 21 and it is shown in drawing 2 It has a diffuser 31, a nozzle 32, a needle 33, the needle maintenance guide 34, the 1st diaphragm 35, and the 2nd diaphragm 36, and is constituted.
[0023] It comes to connect 42 [block / 2nd] on the same axis, and the 1st block of the fluid channel 43 whose diffuser 31 is located in the downstream (method opposite side of the right in drawing 2), which is located in 41 and the upstream (left side in drawing 2) the 1st block and which is penetrated in the direction of an axis is formed in 41. The diameter expansion section 46 which has the inner skin whose diameter is expanded continuously gradually is formed as it has the throat section 44 from which a bore becomes that middle with min, the converging section 45 which has the inner skin whose diameter is reduced continuously gradually is formed as it progresses in the direction of a lower stream of a river rather than this throat section 44 at the upstream, and a fluid channel 43 progresses in the direction of a lower stream of a river rather than the throat section 44 at the downstream. Here, the flare include angle of the diameter expansion section 46 is made smaller than the flare include angle of the converging section 45 of the upstream.
[0024] The 2nd block of the hole 47 prepared in the direction of an axis is formed in 42, and the 1st block of the down-stream edge of this hole 47 is open for free passage to the converging section 45 of 41. On the other hand, the nozzle 32 is being fixed to the upper edge of a hole 47 as it projects on a diffuser 31 and the same axle from upstream end-face 47A. In addition, rather than the nozzle 32, it is the downstream, and the 1st block of the converging section 45 of 41 and the space constituted by the 2nd block of the hole 47 of 42 are made into the ** style room 48, and the 2nd block of the ** style installation tubing 49 for introducing into 42 the blowdown fuel discharged by the ** style room 48 from a fuel cell 21 is connected.
[0025] The fluid channel 51 prolonged along the direction of an axis is formed in the interior of a nozzle 32. In the point of a nozzle 32, inner skin 32A of a nozzle 32 which makes the wall surface of a fluid channel 51 is formed so that the diameter may be gradually reduced continuously toward a head side (downstream of a fluid channel 51). The down-stream edge of a fluid channel 51 stands in a row by apical surface 32B of a nozzle 32 in the opening 52 which carries out opening, and the upper edge of a fluid channel 51 is blockaded by the 1st diaphragm 35. The fuel feeding pipe 53 for introducing into a fluid channel 51 the fuel supplied through the fuel-supply lateral pressure control section 27 from the fuel-supply section 22 is

connected.
[0026] The needle 33 is inserted in the interior of a nozzle 32 at a nozzle 32 and the same axle, and the needle 33 is held possible [sliding] to the direction of an axis of a nozzle 32 and the same axle with the needle maintenance guide 34. Here, in the point of a needle 33, peripheral face 33A of a needle 33 is formed so that the diameter may be gradually reduced continuously toward a head side. That is, the amount of projection of the point of the needle 33 which projects from the opening 52 of a nozzle 32 is made to change because a needle 33 slides in the direction of an axis inside a nozzle 32. In connection with this, the opening area of the gap of inner skin 32A of a nozzle 32 and peripheral face 33A of a needle 33 is made to change, and adjustment of the flow rate of the fuel injected in the sub** room 48 from the opening 52 of a nozzle 32 is enabled.
[0027] In addition, the needle maintenance guide 34 which holds a needle 33 possible [sliding] to the direction of an axis is formed in the annulus ring tabular which has the proper breakthrough which can circulate a fluid, and the needle 33 is inserted in needle insertion hole 34a penetrated in the direction of an axis. Where a needle 33 is inserted in needle insertion hole 34a, it is fixed here. Where inner skin 32A of a nozzle 32 is contacted, sliding of the peripheral face of the needle maintenance guide 34 may be enabled, and or it is fixed after the peripheral face of the needle maintenance guide 34 has contacted inner skin 32A of a nozzle 32, and it is alike, needle insertion hole 34a is received, and sliding of a needle 33 may be enabled.
[0028] Connection immobilization of the 1st diaphragm 35 which blockades the upper edge of the fluid channel 51 of the nozzle 32 interior, and the 2nd diaphragm 36 with which only predetermined distance has been estranged and arranged to the 1st diaphragm 35 at the downstream of the direction of an axis is carried out at the end face section of a needle 33. Furthermore, while the 1st and 2nd diaphragms 35 and 36 are having the perimeter fixed by case 10a of the adjustable flow rate ejector 10 It makes it possible for the amount of [of the 1st and 2nd diaphrams 35 and 36] abbreviation center section to move in the direction of an axis shown in drawing 2 . Combo RIUMU 35a and 36a which controls moving in the direction which intersects perpendicularly with an axis on the other hand is formed possible [elastic deformation], and the needle 33 is made to be displaced by migration of the 1st and 2nd diaphragms 35 and 36 in the direction of an axis. And as the fluid channel 51 of the nozzle 32 interior is adjoined through the 1st diaphragm 35 in the direction of an axis, the air extreme pressure induction room 54 is formed of the 1st diaphragm 35, the 2nd diaphragm 36, and case 10a, and the air extreme pressure installation tubing 55 for branching and introducing into this air extreme pressure induction room 54 the air supplied to the air pole side of a fuel cell 21 is connected.
[0029] Here, as shown in the following formula (1), the pressure deltaP1 which acts on the 1st diaphragm 35 is expressed as differential pressure of the pressure Pa of the fuel supplied to the fluid channel 51 of the nozzle 32 interior through the fuel-supply lateral pressure control section 27 from the fuel-supply section 22, and the pressure Pair of the air by the side of the air pole of a fuel cell 21.
[0030]
[Equation 1]
$$\Delta P1 = Pa - Pair \quad \cdots\cdot (1)$$

[0031] Furthermore, as the air extreme pressure induction room 54 is adjoined through the 2nd diaphragm 36 in the direction of an axis, the fuel extreme pressure induction room 56 is formed of the 2nd diaphragm 36 and case 10a, and the fuel extreme pressure installation tubing 57 for branching and introducing into this fuel extreme pressure induction room 56 the fuel supplied to the fuel electrode side of a fuel cell 21 is connected. Here, as differential pressure with the pressure Pair of the air by the side of the air pole of a fuel cell 21 and differential pressure with the pressure Pfuel of the fuel by the side of the fuel electrode of a fuel cell 21, i.e., electrode differential pressure of a fuel cell 21, as shown in the following formula (2), the pressure deltaP2 which acts on the 2nd diaphragm 36 is expressed. In addition, the end of the fuel extreme pressure installation tubing 57 is connected to the fuel extreme pressure induction room 56, and the other end is connected near the down-stream edge of a diffuser 31.
[0032]
[Equation 2]
$$\Delta P2 = Pfuel - Pair \quad \cdots\cdot (2)$$

[0033] The fuel cell system 20 equipped with the adjustable flow rate ejector 10 by the gestalt of this operation is equipped with the above-mentioned configuration. Next, it explains, referring to an

accompanying drawing about actuation of this adjustable flow rate ejector 10. Drawing 3 and drawing 4 are the important section simplified schematics showing flow rate change of the adjustable flow rate ejector 10 accompanying change of the electrode differential pressure of a fuel cell 21, and especially drawing 4 is drawing showing the variation rate of the needle 33 at the time of increasing the electrode differential pressure of a fuel cell 21. In this adjustable flow rate ejector 10, the blowdown fuel of a fuel cell 21 is supplied from the ** style installation tubing 49, and a fuel is supplied to the fluid channel 51 of the nozzle 32 interior from a fuel feeding pipe 53. Then, a fuel is injected toward the fluid channel 43 of a diffuser 31 from a gap with the opening 52 32 of a nozzle 32, i.e., a nozzle, and a needle 33. At this time, negative pressure occurs [near the throat section 44 of the diffuser 31 with which a high-speed fuel style circulates], and the ****** style in the ** style room 48 is absorbed by the fluid channel 38, and it mixes with the fuel injected from the nozzle 32, and is discharged by this negative pressure from the down-stream edge of a diffuser 31. Thereby, the blowdown fuel discharged from the fuel cell 11 is circulated through the adjustable flow rate ejector 10.

[0034] In the fuel-supply lateral pressure control section 27, to the pressure Pair of the air supplied as signal pressure, if it is set as Pa=Pair+200kPa, at this time, the pressure deltaP1 which acts on the 1st diaphragm 35 will serve as deltaP1=200kPa in the pressure Pa of the fuel supplied to the adjustable flow rate ejector 10. Furthermore, the pressure deltaP2 which acts the electrode differential pressure of a fuel cell 21 on place constant pressure, for example, 20kPa(s), then the 2nd diaphragm 36 serves as deltaP2=20kPa. Therefore, in the above-mentioned setting out, the relation of deltaP1:deltaP2=10:1 is always materialized.

[0035] Here, as shown in drawing 3 , the electrode differential pressure of a fuel cell 21 is automatically maintainable to 20kPa(s) which are place constant pressures by setting up the area S1 of the 1st diaphragm 35 in the condition of not carrying out elastic deformation, by 10 times (that is, S2=10xS1) the area S2 of the 2nd diaphragm 36 in the condition of not carrying out elastic deformation. That is, as shown, for example in drawing 4 , when the amount of the fuel consumed with a fuel cell 21 decreases and the amount of generations of electrical energy falls, the electrode differential pressure of a fuel cell 21 increases. Then, the pressure deltaP2 which acts on the 2nd diaphragm 36 increases, each combo RIUMU 36a and 35a of the 2nd diaphragm and the 1st diaphragm carries out elastic deformation in the direction of an axis, and the 1st diaphragm 35 and the 2nd diaphragm 36 move.

[0036] Thereby, the needle 33 fixed to the 2nd diaphragm 36 and the 1st diaphragm 35 displaces in the direction of an axis (it is the other side to the downstream), and the amount of projection of the point of the needle 33 which projects from the opening 52 of a nozzle 32 is made to change (for example, increment). The opening area of the gap of inner skin 32A of a nozzle 32 and peripheral face 33A of a needle 33 is made to change (for example, reduction), and the flow rate of the fuel injected in the sub** room 48 from the opening 52 of a nozzle 32 is made to adjust in connection with this (for example, reduction). Then, the pressure Pfuel of the fuel by the side of the fuel electrode of a fuel cell 21 decreases, and a needle 33 comes to be held in the proper location where the pressure deltaP1 which acts on the 1st diaphragm 35, and the pressure deltaP2 which acts on the 2nd diaphragm 36 balanced.

[0037] As mentioned above, according to the adjustable flow rate ejector 10 by the gestalt of this operation Based on the pressure Pair of the air by the side of the air pole (cathode) of a fuel cell 21, and the pressure Pfuel of the fuel by the side of the fuel electrode (anode) of a fuel cell 21, with the simple configuration which controls the flow rate of the fuel supplied to a fuel cell 21 Only by the mechanical control set up beforehand, without being able to come, simultaneously being able to control a SUTOIKI property and needing electric control, controlling the predetermined electrode differential pressure needed between the fuel electrode of a fuel cell 21, and an air pole to high degree of accuracy The flow rate of the fuel supplied to a fuel cell 21 can be controlled appropriately, and it becomes possible to prevent complicating the fuel cell system 20 and to ** it to the cutback of the costs which construction of a reliable system takes.

[0038] In addition, although the pressure ratio of the pressure deltaP1 which acts on the 1st diaphragm 35, and the pressure deltaP2 which acts on the 2nd diaphragm 36 was made into the predetermined value, deltaP1:deltaP2=10:1 [i.e.,], in the gestalt of this operation For example, the surface ratio of the 1st diaphragm 35 and the 2nd diaphragm 36 can be changed, or it can change into a proper pressure ratio by changing setting out of the fuel-supply lateral pressure control section 27 which makes a proportion pressure control valve etc.

[0039]

[Effect of the Invention] As explained above, according to the adjustable flow rate ejector of this invention according to claim 1, the flow rate of the interflow object of the 1st fluid and the 2nd fluid which are sent out from a diffuser can be appropriately adjusted only by the mechanical control based on pressure

balancing of the 1st fluid, the 3rd fluid, and the 4th fluid. Though it is a simpler configuration compared with the case where control of flow of a high resolution and high degree of accuracy is performed using an electric actuator etc. thereby, for example, the amount control of pressure flow with desired high dependability can be performed.

[0040] Moreover, in case the recirculation of the blowdown fuel discharged from a fuel cell is mixed and carried out to the fuel newly supplied by the fuel cell with a predetermined blowdown flow rate according to the fuel cell system of this invention according to claim 2, the flow rate of the interflow object of the fuel supplied to a fuel cell and a blowdown fuel can be appropriately adjusted only by the mechanical control based on pressure balancing of the 1st fluid, the 3rd fluid, and the 4th fluid. Though it is a simpler configuration compared with the case where control of flow of a high resolution and high degree of accuracy is performed using an electric actuator etc. thereby, for example, the amount control of pressure flow with desired high dependability can be performed, it can prevent complicating control of a fuel cell system, and the costs required in case a system is built can be reduced.

[0041] Furthermore, according to the fuel cell system of this invention according to claim 3, though it is a simpler configuration compared with the case where control of flow of a high resolution and high degree of accuracy is performed, for example using an electric actuator etc., reliable control of flow can be performed, holding the electrode differential pressure of the request needed for a fuel cell. Furthermore, according to the fuel cell system of this invention according to claim 4, based on the electrode differential pressure of a fuel cell, and the supply pressure of the fuel according to the pressure of the oxidizer in a fuel-supply means, the surface ratio which will be in the keeping condition of a pressure in each of the 1st and 2nd diaphragms which have not carried out elastic deformation can be set up. When change of the electrode differential pressure of a fuel cell etc. occurs, the displacement location of the needle in the direction of a medial-axis line is changed because the 1st and 2nd diaphrams move from this keeping condition, and the flow rate of the fuel supplied to a fuel cell and a blowdown fuel is automatically set as a suitable value.

[Translation done.]

* NOTICES *

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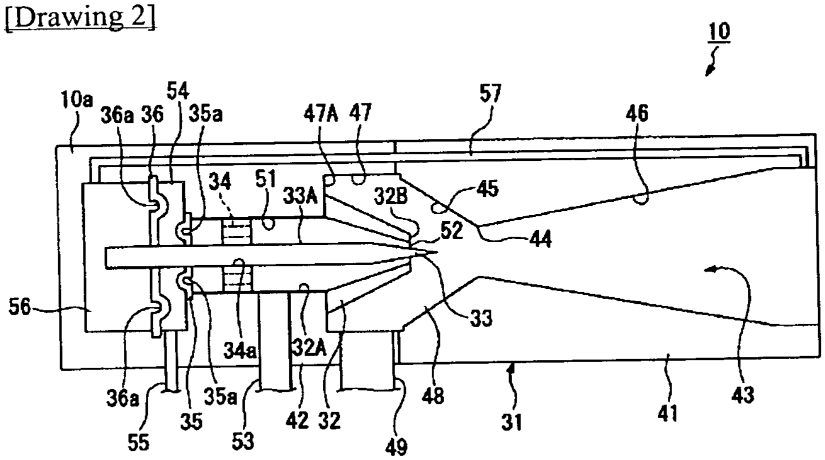
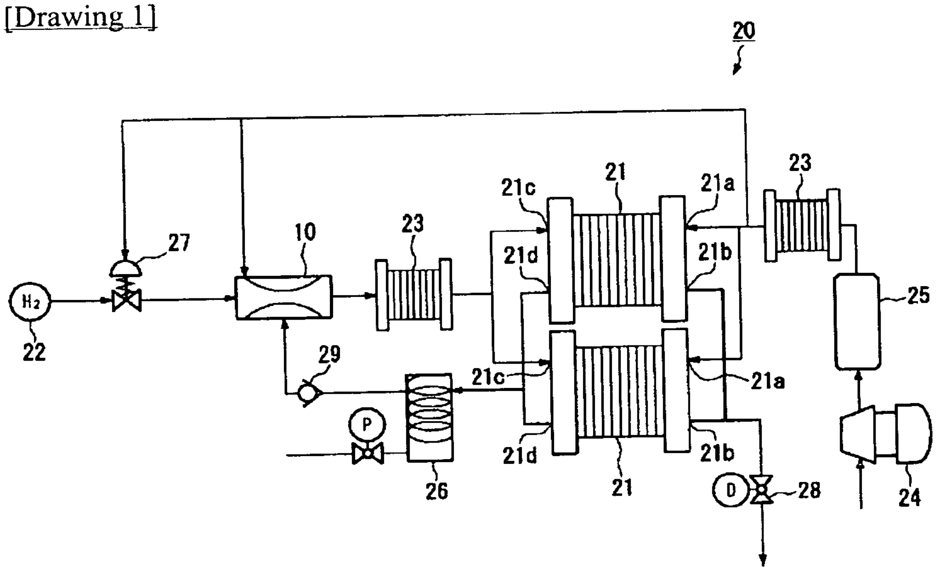
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

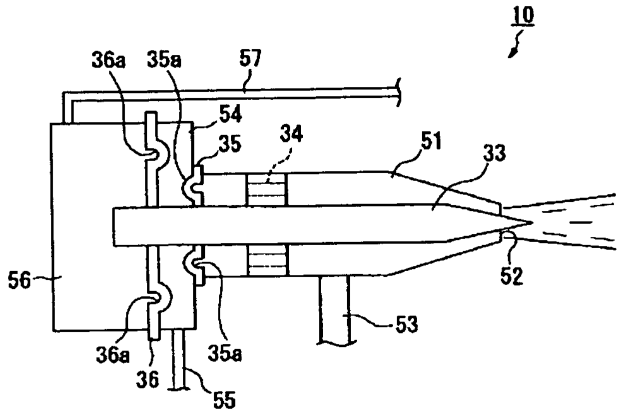
[Drawing 2]



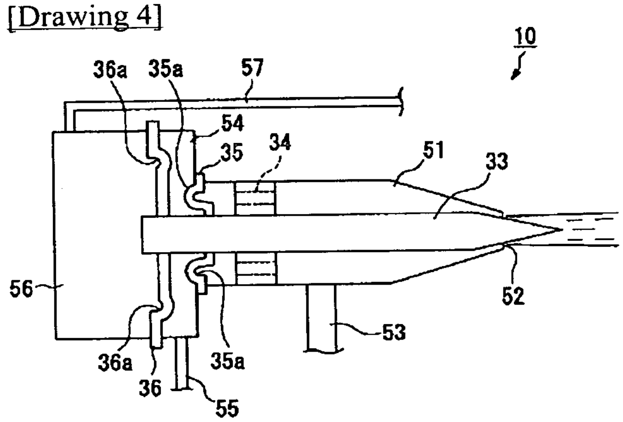
[Drawing 1]



[Drawing 3]



[Drawing 4]



[Translation done.]